



*Efficient pollution control requires that society make value judgments concerning the dollar value of lower mortality and morbidity rates.*

## Environmental Economics and Human Health

Environmental economics has made numerous contributions to both the theory and the applied problems surrounding pollution control. Given that the primary benefits of controlling most pollutants are health benefits, there is a close link between human health and environmental economics.

One of the most important contributions that economics has made to the problem of pollution control is to clarify the objective of social policy. The objective of controlling pollution is to minimize the total costs to society, where these costs include the damages from remaining pollution and the abatement cost required to eliminate pollution. The optimal policy keeps the total cost to society from pollution as small as possible. Additional pollution should be removed as long as the damages removed are less than the cost of additional abatement. Although this is a straightforward application of common sense, this optimal policy is nonetheless controversial, as many environmental advocates would prefer simply to minimize pollution itself. Even within the health community, there are many who would advocate minimizing health effects regardless of cost. However, going beyond the optimal strategy and minimizing health effects would eliminate only a small amount of health loss while costing a great deal of abatement resources. Rather than spending huge resources chasing the last elements of pollution, environmental economics suggests diverting those resources to save more lives in other more promising activities such as reducing driving fatalities or fighting curable diseases.

Another major contribution of environmental economics is proof that government intervention is necessary to control pollution. A few observers, such as Ronald Coase (1), dissented and argued that victims would willingly bribe polluters for clean air. But the profession recognizes that, in general, victims do not and cannot organize themselves to make offers to polluters. There are simply too many people damaged by most emissions of pollution for them to act as a single coordinated agent. With victims having different tastes and incomes, they cannot agree how much to pay and how much to control the pollution. In the absence of government intervention, the market simply does not get organized and so fails to abate.

At first, government intervention meant regulations or standards. The Clean Air Act in 1970 began federal control of the primary air pollutants (sulfur dioxide, particulates, carbon monoxide, ozone, nitrogen dioxide, and lead). The Clean Water Act followed suit and provided federal regulations to protect water resources. Further laws have been passed to regulate hazardous wastes, radioactive wastes, and pesticides. All of these laws established uniform standards, which were easy to understand and easy to enforce, and they made it easy to predict what would happen. The problem with standards is that they did not abate pollution efficiently. The marginal cost of control is high for some firms and low for others. Uniform regulations treat all firms the same. This leads to higher costs. Regardless of the total



**Robert Mendelsohn**

amount of abatement sought, uniform regulations led to inefficient abatement programs.

One of the most exciting innovations in pollution management in the last decade concerns the adoption of new market mechanisms to encourage efficient abatement. Economists have long advocated using taxes to control pollution. Charging a uniform price per unit of emission has the very desirable property of equating the marginal cost of abatement across firms. Firms evaluate whether paying the tax or abating is cheaper. In the process, they set their marginal costs equal to the tax rate. Because all of the firms face the same tax rate for each pollutant, they equilibrate their marginal costs with each other. This leads to the cheapest possible combination of abatement efforts across firms for any given aggregate target. For every type of pollution, the taxes could reduce the amount of abatement costs for any given targeted level of aggregate pollution. The problem with taxes, of course, is that no one wants to pay them. Polluting firms are no exception, and they have successfully lobbied not to use taxes. Environmentalists have unfortunately contributed to this effort by also rejecting taxes.

Rather than relying on unpopular taxes, economists now advocate tradable permits. By starting with permits, it is possible to keep one of the important advantages of standards: a guaranteed minimum amount of aggregate abatement. However, by allowing polluters to trade their permits among themselves, the cost of the program can be greatly reduced. Firms with high marginal costs can buy permits and pollute more, whereas firms with low marginal costs can sell permits and abate more. The environment does not suffer, and yet abatement costs can be dramatically reduced. By using market mechanisms wisely, the government can protect the environment and human health but lower the cost of the program to society. In the last decade, the United States has successfully implemented a tradable permit system for sulfur dioxide.

In addition to theory, environmental economists have also helped measure the damages and the costs of pollution control. For example, they have often been advocates of integrated assessment. Environmental economists and experts from decision science have long recognized the merit of combining the many environmental sciences necessary to connect a cause and its final effect. Understanding the science behind pollution is quite difficult, and few people have command of all the necessary elements. Engineering is needed to determine what can be done at the production end to reduce pollution or remove it before it gets into the environment. Meteorology and atmospheric chemistry are needed to understand where pollutants go in the atmosphere and how they change. Hydrology serves the same purpose for water pollution. Population mapping is needed

to determine who will be exposed to the resulting distribution of pollution across space. Toxicology and epidemiology are needed to estimate the health effects the pollution exposure is likely to cause. Integrated assessment models organize all this information into a consistent framework that tracks initial decisions to control the pollution to their final consequences. This tool makes environmental science directly available to the policy decision maker.

Integrated assessment models, however, also highlight the need for controversial judgments. How important are different health outcomes? Similar to debates in the medical literature concerning the quality of life gained from alternative medical treatments, efficient pollution control requires that society make value judgments concerning the dollar value of lower mortality and morbidity rates. These value judgments are needed to compare the abatement dollars to reduce pollution against the removed consequences. Are the abatement dollars worth spending, given the resulting change in final consequences? Many of these consequences are health effects, although there are also visibility, material damages, and ecosystem effects that must be valued as well.

Economists have contributed to the debate about values by examining a number of choices that people have made between money and health. For example, some people accept higher wages as compensation for more risky jobs. By examining how much more these people must be paid, economists have been able to value small changes in mortality or morbidity rates. Economists have also looked at how much more homes are worth in cleaner environments. These studies reveal that clean air increases housing value. Finally, economists have conducted a number of surveys that simply ask people how they would trade income and health or income and visibility. Valuing health is obviously controversial because each person may place a different value on health. The problem facing society with pollution control is that we must make decisions that are not specific to each person but rather apply to us all. It is therefore not surprising that there is such controversy about picking a single value for health. This controversy clearly underlies much of the tension that is readily evident in every public debate about pollution control.

Environmental economists have also made some direct contributions to epidemiology. Relying on statistical skills that have been developed in economics, some economists have been adventurous enough to

actually conduct epidemiologic studies. Specifically, they have advocated using cross-sectional data sets to try to sort out the impacts of ubiquitous pollutants. Pollutants such as sulfur dioxide and particulates are everywhere. It therefore might seem straightforward to construct natural experiments that compare areas with high, medium, and low pollution levels. The problem is that pollution levels could easily be correlated with other factors across space that are just as potent. For example, pollution tends to be high in central cities, but central cities are also plagued by low income, poor housing, and deteriorating social services. In contrast, pollution levels are low in rural areas, but these locations may have poor medical services, lower education, and more rugged lifestyles. Assuming that the effect of pollution can be easily discerned by comparing one central city, one suburb, and one rural area is a leap of faith. Economists have consequently been advocating using broader cross-sectional data that includes many cities, many suburbs, and many rural areas as a tool to sort out the effects of pollution from the effects of these other factors. Unfortunately, broad cross-sectional analysis has been poorly received by the epidemiologic community, and the approach has been largely abandoned.

In conclusion, the most important contribution that environmental economists have made to protect health is providing a clear objective to evaluate pollution decisions. By weighing the benefits of more control against the cost of abatement, economists have sought a balanced approach for society. Economists have also advocated the wise use of scientific information by building integrated assessment models from all relevant disciplines. Finally, economists have worked hard to give the government tools that promote efficient abatement programs. All of these efforts are designed to make our pollution control programs more effective so they deliver an adequately safe environment at the lowest possible cost.

**Robert Mendelsohn**

Yale School of Forestry and Environmental Studies

New Haven, Connecticut

E-mail: robert.mendelsohn@yale.edu

#### REFERENCES AND NOTES

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